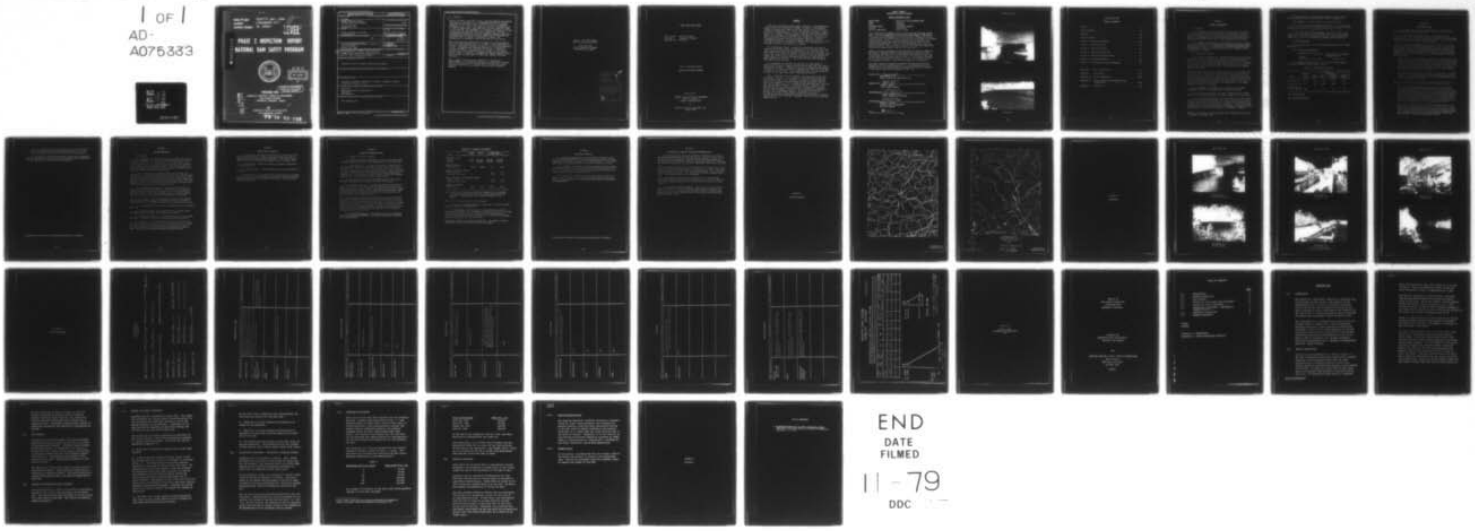
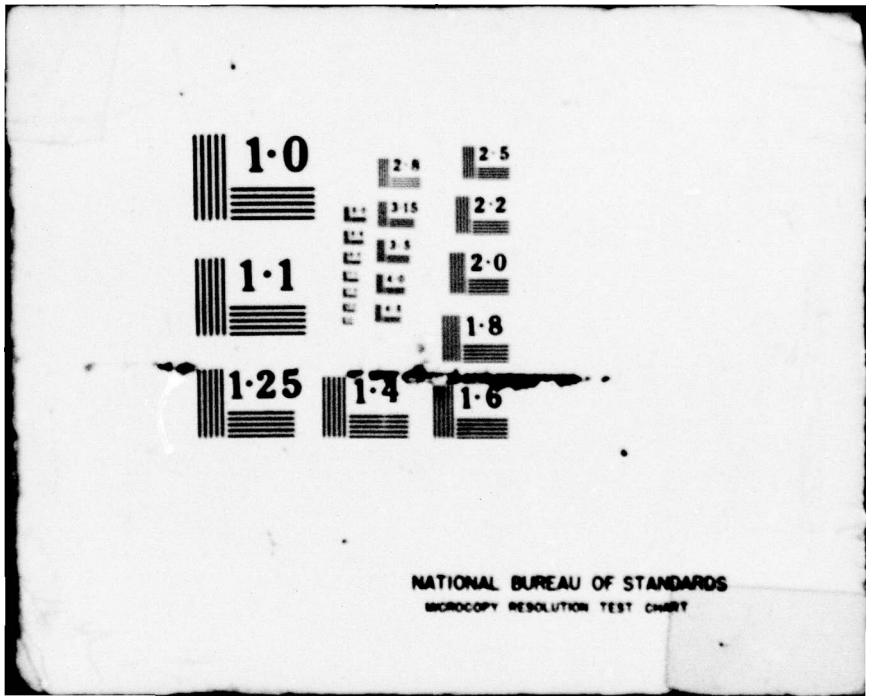
AD-A075 333 MARTIN (DEWARD M) AND ASSOCIATES INC WILLIAMSBURG VA F/G 13/2
NATIONAL DAM SAFETY PROGRAM. SCOTTS MILL DAM (VA-68001), UPPER --ETC(U)
AUG 79 DACW65-78-D-0015
UNCLASSIFIED NL

1 OF 1
AD-
A075333



END
DATE
FILMED
11-79
DDC


1·0
1·1
1·25
1·4
1·6
2·5
2·2
2·0
1·8
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Name Of Dam: SCOTT'S MILL DAM
Location: LYNCHBURG CITY
Inventory Number: VA. 68001

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

DEWARD M. MARTIN & ASSOCIATES
WILLIAMSBURG, VIRGINIA
AUGUST, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VA 68001	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program SCOTT'S MILL DAM LYNCHBURG CITY, VA		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) DEWARD M. MARTIN & ASSOCIATES WILLAIMSBURG, VA		8. CONTRACT OR GRANT NUMBER(s) (15) (DM - DACW 65-78-D-0015)
9. PERFORMING ORGANIZATION NAME AND ADDRESS (9) Final rept.		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (12) 46
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineering District, Norfolk (11) 803 Front Street Norfolk, VA 23510		12. REPORT DATE August 1979 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) (16) National Dam Safety Program. Scotts Mill Dam (VA-68001), Upper James River Basin, Lynchburg, Virginia. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

H11 362 JCB

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

SCOTTS MILL DAM
CITY OF LYNCHBURG, VIRGINIA
INVENTORY NO. VA 68001

UPPER JAMES RIVER BASIN

Name of Dam: Scotts Mill Dam
Location: Lynchburg, Virginia
Inventory No.: VA 68001

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Prepared for

NORFOLK DISTRICT CORPS OF ENGINEERS
803 Front Street
Norfolk, Virginia 23510

by

Deward M. Martin & Associates, Inc.
August 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Scotts Mill Dam (Lynchburg Dam)
State:	Virginia
City:	Lynchburg
USGS Quad Sheet:	Lynchburg, Virginia
Stream:	James River
Date of Inspection:	July 12, 1979

Scotts Mill Dam is a masonry structure about 925 feet long and 15 feet high. The dam is owned by the Appalachian Power Company. The dam is classified as an intermediate size structure with a significant hazard classification. The entire length of the dam is the spillway at a uniform crest elevation of 511.0. The left abutment sluice gates have been plugged with concrete and are now buried beneath the rubble of the recently demolished mill. Some of the right abutment canal gates are still functional. They are used to regulate the canal water supply for Griffin Pipe Company plant located on the right shore.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood is 1/2 PMF. The spillway will pass 6% of the PMF without overtopping the dam. The height of the dam is defined as the height of the structural abutment. The 1/2 PMF will overtop the dam by 25.5 feet. The spillway is therefore adjudged inadequate. The dam was designed to be overtopped.

The visual inspection revealed no apparent problems and there is no immediate need for remedial measures. It is recommended within 12 months that an annual maintenance and inspection program be initiated to help detect and control problems that may occur.

Prepared By: Frank Seiler
PAUL SEILER, P. E.
Deward M. Martin & Associates, Inc.

Original signed by
Submitted By: JAMES A. WALSH
JAMES A. WALSH
Chief, Design Branch

Original signed by:
Recommended By: Carl S. Anderson, Jr.
for JACK G. STARR, P. E.
Chief, Engineering Division

Original signed by:
Approved By: LTC Leonard C. Gregor
for DOUGLAS L. HALLER
Colonel, Corps of Engineers
District Engineer

Date SEP 28 1979

Overview

Front View

SCOTTS MILL DAM

TABLE OF CONTENTS

Preface	i
Prief Assessment	ii
Overview	iii
Table of Contents	iv
Section 1 - Project Information	1-1
Section 2 - Engineering Data	2-1
Section 3 - Visual Inspection	3-1
Section 4 - Operational Procedure	4-1
Section 5 - Hydraulic/Hydrologic Data	5-1
Section 6 - Structural Stability	6-1
Section 7 - Assessment and Remedial Measures	7-1
Appendix I - Maps and Drawings	I-1
Appendix I - Photographs.	II-1
Appendix III - Field Observations	III-1
Appendix IV - Partial Report, 1978, Woodward-Clyde Consultants	IV-1
Appendix V - References	V-1

SECTION 1

PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams through the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I Inspection according to the Recommended Guidelines for Safety Inspection of Dams (Appendix V, Reference 1). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Scotts Mill Dam is a masonry structure about 925 feet long and 15 feet high.* Approximately 125 feet adjacent to the right abutment is constructed as a flat arch having a rise of about 24 feet. The remaining length of the dam is on a tangent. The crest of the dam (top of the canal gates structure) is at elevation of 516.5 with a width of 36 feet. The spillway crest is approximately 3 feet wide.

The entire length of the dam is the spillway with a uniform crest elevation of 511.0. There was an old mill and sluice gate structure at the left abutment. The sluice gates have been plugged with concrete and are now buried beneath the rubble of the recently demolished mill. A canal with canal gates at the right abutment is used to supply water for the Griffin Pipe Company plant on the right shore. There are three 4-foot x 3-foot canal gates to allow water to enter the canal, however, only two are functional.

1.2.2 Location: Scotts Mill Dam is located on James River approximately 2,000 feet upstream from U S Route 29 Business.

1.2.3 Size Classification: The dam is classified as an "intermediate" sized structure because of maximum storage (3,950 acre feet.)

1.2.4 Hazard Classification: The dam is located near the Griffin Pipe Company plant in the Lynchburg city limits and is therefore given a significant hazard classification in accordance with guidelines contained in Section 2.1.2 of Reference 1, Appendix V. The hazard classification used to categorize the dams is a function of location only and has nothing to do with their stability or probability of failure.

*Height of the dam is from the spillway crest (elevation 511) to the streambed at elevation 496±.

1.2.5 Ownership: Appalachian Power Company, Virginia (A subsidary company of American Electric Power Service Corporation.)

1.2.6 Purpose: To supply water to Griffin Pipe Company.

1.2.7 Design and Construction History: There is no engineering design or construction data available for the dam. The dam is believed to have been constructed to provide power for a mill in 1839.

1.2.8 Normal Operational Procedures: Water is released to the canal at the right abutment to the Griffin Pipe Company plant on the right shore. Otherwise, regulation of flows is automatic with water rising above the crest of the spillway passing freely downsteam.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 3,400 square miles.

1.3.2 Discharge at Dam Site:

Maximum flood - 150,000 c.f.s. (1969, Hurricane Camille). (Paragraph 5.3)

Spillway
pool level at top of dam . . . . . .39,370 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet m.s.l.	Reservoir Area acres	Reservoir Capacity Acre feet	Reservoir Capacity Watershed inches	Reservoir Length (a) miles
Top of Dam (b)	516.5	410	3,950	0.02	3.8
Spillway crest	511	370	1,800	0.01	3.8
Streambed at the toe of the dam	496±	--	---	--	--

(a) To Reusens Dam

(b) Structural Abutment

SECTION 2

ENGINEERING DATA

2.1 Design: There were no design drawings or data available for the Scotts Mill (or Lynchburg) Dam.

*2.1.1 Geologic Setting of the Dam: The Lynchburg Dam is located in the Valley and Ridge physiographic province. The underlying rock of the dam site is of the Lynchburg Formation. This consists of phyllite, quartzite, graywacke, and conglomerate.

*2.1.2 Geologic Investigations: No known subsurface investigations were conducted in conjunction with the original construction of the Lynchburg Dam. In 1978 an inspection was made by Woodward Clyde Consultants of Clifton, New Jersey for American Electric Power Co., the owner of the dam (see appendix IV). While no subsurface investigation was done for this inspection, the following report of the site geology was made:

"Lynchburg Dam is located within the Valley and Ridge physiographic province where the bedrock is a portion of the Lynchburg Formation. Although steeply folded, the phyllite bedrock (a metamorphic rock between a slate and schist), which is the primary rock material in the area, exposed near the left abutment appears very competent. The strike of the bedrock in the vicinity of the dam is approximately parallel to the axis of the dam.

The dam and the former canal system are constructed of cut blocks of gneiss. These gneissic blocks show no weathering on exposed surfaces. Solution channeling or erosion from seepage within the bedrock should not be expected.

2.2 Construction: The report by Woodward-Clyde Consultants (Appendix IV), describes the construction of the dam as follows:

"The dam is believed to have been constructed to provide power for a mill sometime between 1830 and 1840. Lynchburg Dam is completely formed of large stone blocks, apparently quarried from portions of the bedrock of the area. It spans the entire width of the James River at a uniform crest elevation, reported to be elevation 515.3 feet (USGS sea level datum). It crosses the James River at a location where the hard rock of the river bottom is at or near elevation 500 feet. Thus, the structural height of the dam, from foundation to crest, is approximately 15 feet.

The dam was constructed in two sections; a straight-line section between Daniel Island and the eastern shore of the river, and an arc section, curved upstream between the western shore and Daniel Island. Both sections function as gravity dams, depending largely on the weight of the blocks to resist sliding and overturning. The total crest length is approximately 925 feet.

There is a small masonry or stone structure at the tip of Daniel Island separating the curved and straight-line portions of the dam. The purpose or function of this structure is not known."

2.3 Evaluation: Detailed evaluations of design and construction data are not possible or necessary since the dam has been in operation for 140 years without any known major deterioration.

*Information provided by Law Engineering Associates of Virginia.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 12 July 1979 inspection are recorded in Appendix III. At the time of the inspection, the pool elevation was at 511.5 feet which is 0.5 feet above normal. Water can be diverted through a portion of the canal along the right bank of the river, to the Griffin Pipe Company. The canal is about 20 feet wide between masonry walls for about 300 feet and about 40 feet wide with earth banks near the pipe company.

3.1.2 Dam: There was no apparent vertical or horizontal misalignment of the dam and no major cracks were detected, however, since the spillway constitutes virtually the entire dam, much of the structure was under water and, therefore, inaccessible. Some seepage was noted through the berm separating the canal and the river at the right abutment. Dampness was detected at the left abutment and there was some intermittant seepage in the abutment joints.

3.1.3 Appurtenant Structures: A small masonry structure is located at the tip of Daniel Island. It separates the straignt and curved portions of the dam and it appears to be in good condition. The canal adjacent to the right abutment, shows no signs of significant deterioration, but there are cap stones loose and dislodged.

3.1.4 Spillway: The entire dam is an ungated masonry spillway which shows no obvious signs of deterioration, however, a detailed investigation was not possible since water was flowing over the crest.

3.1.5 Instrumentation: There is no instrumentation on the Scotts Mill Dam.

3.1.6 Reservoir Area: The reservoir area is contained within the natural bed of the river and is heavily forrested.

3.1.7 Downstream Channel: The downstream channel is the natural riverbed. The banks of the channel are steep and heavily wooded.

3.2 Evaluation: The visual inspection indicated that the dam was in good condition although most of it was under water at the time. The seepage through the berm separating the canal and the river at the right abutment, was less than a rate of half gallon per minute. There is no need for immediate remedial action on the dam.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure: The dam is currently used to supply water for the Griffin Pipe Company. Water is diverted through the canal by manually opening two of the three canal gates. The normal regulation of flow is automatic as water passes over the spillway crest.

4.2 Maintenance: There is no current maintenance program for the Scotts Mill Dam.

4.3 Warning System: No warning system has been established for this dam.

4.4 Evaluation: An extensive operation and maintenance program is not required for this dam, however, an annual inspection and maintenance program should be initiated to help detect and control problems that may occur.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: Hydrologic recored are available from the gaging station at Holcomb Rock approximately 15 miles upstream.

5.3 Flood Experience: The dam has experienced numerous severe floods and ice conditions on the river such as that of March 1936 (115,000 c.f.s., water reached elevation 606 feet m.s.l. at the dam.) The Camille Flood, which is the highest on record, occurred on August 20, 1969. The Holcomb Rock Station recorded a maximum discharge, 150,000 c.f.s., gage height, 35.5 feet, from a rating curve extended above 73,000. Two additional floods occurred in 1972.

5.4 Flood Potential: The peak flood discharges of PMF and 1/2 PMF were developed and furnished by the Corps of Engineers.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1. Water is passed from the reservoir through the canal gates near the right abutment to regulate the canal water supply for the Griffin Pipe Company plant located on the right shore. Water also flows past the dam over the spillway in the event water in the reservoir rises above elevation 511.0.

The Corps of Engineers concluded that "The storage in the reservoirs are so small compared to the volume of the flood hydrographs that no computable reduction in discharge would be made. Therefore, routing through either upstream reservoirs or through the reservoir of the dam being studied, will not be necessary. Therefore, the outflow will equal the inflow and maximum elevation reached in a particular flood can be determined by applying the peak flow rate to the elevation-discharge relation for the dam.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal Flow	March 1936	Hydrograph 1/2 PMF	Hydrograph PMF (a)
Peak Flow, c.f.s.				
Inflow	2,000	115,000	355,000	710,000
Outflow	--	115,000	355,000	710,000
Maximum elevation feet, m.s.l.	511.0	523.8	542	566.5
Spillway (elevation 511.0)				
Depth of flow			31.0	55.5
Velocity, f.p.s. (b)			10.0	12.7
Non-overflow Section (elevation 516.5)				
Depth of flow			25.5	50.0
Velocity, f.p.s. (b)			10.0	12.7
Tailwater elevation, feet, m.s.l.	499±	521.2	540.2	564.8

(a) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

(b) Average velocity will be with tailwater.

5.7 Reservoir Emptying Potential: There are no facilities available for dewatering the reservoir.

5.8 Evaluation: Based on the size (intermediate) and hazard (high) classifications, the recommended Spillway Design Flood is 1/2 PMF. The spillway will pass 6% of the PMF without overtopping the dam. The SDF will overtop the dam by a maximum of 25.5 feet with an average critical velocity of 10.0 feet per second.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

STRUCTURAL STABILITY

*6.1 Foundation and Abutments: The underlying bedrock is from the Lynchburg Formation which is primarily phyllite bedrock and other metamorphic rock which is evidence of a firm foundation. There are no known previous reports detailing the specific geology of the area.

6.2 Stability: No stability analyses were performed in conjunction with this study and none are known to have been performed in the past. The calculation of overturning based on assumed conditions is shown in Appendix III - Gravity Dam Design.

6.3 Evaluation: Despite the lack of data, the dam seems to be stable. The wall along the canal has loose cap stones but does not affect the dam structure. The stone dam has no signs of misalignment or deterioration.

*Information provided by Law Engineering Associates of Virginia.

SECTION 7

ASSESSMENT AND REMEDIAL MEASURES/RECOMMENDATIONS

7.1 Dam Assessment: The data available is inadequate to evaluate the design and construction of the dam, however, the long history of the dam and the visual inspection indicated that it was well constructed. The visual inspection did not reveal any deficiencies which were critical, however, since the majority of the dam is underwater, this may be inclusive.

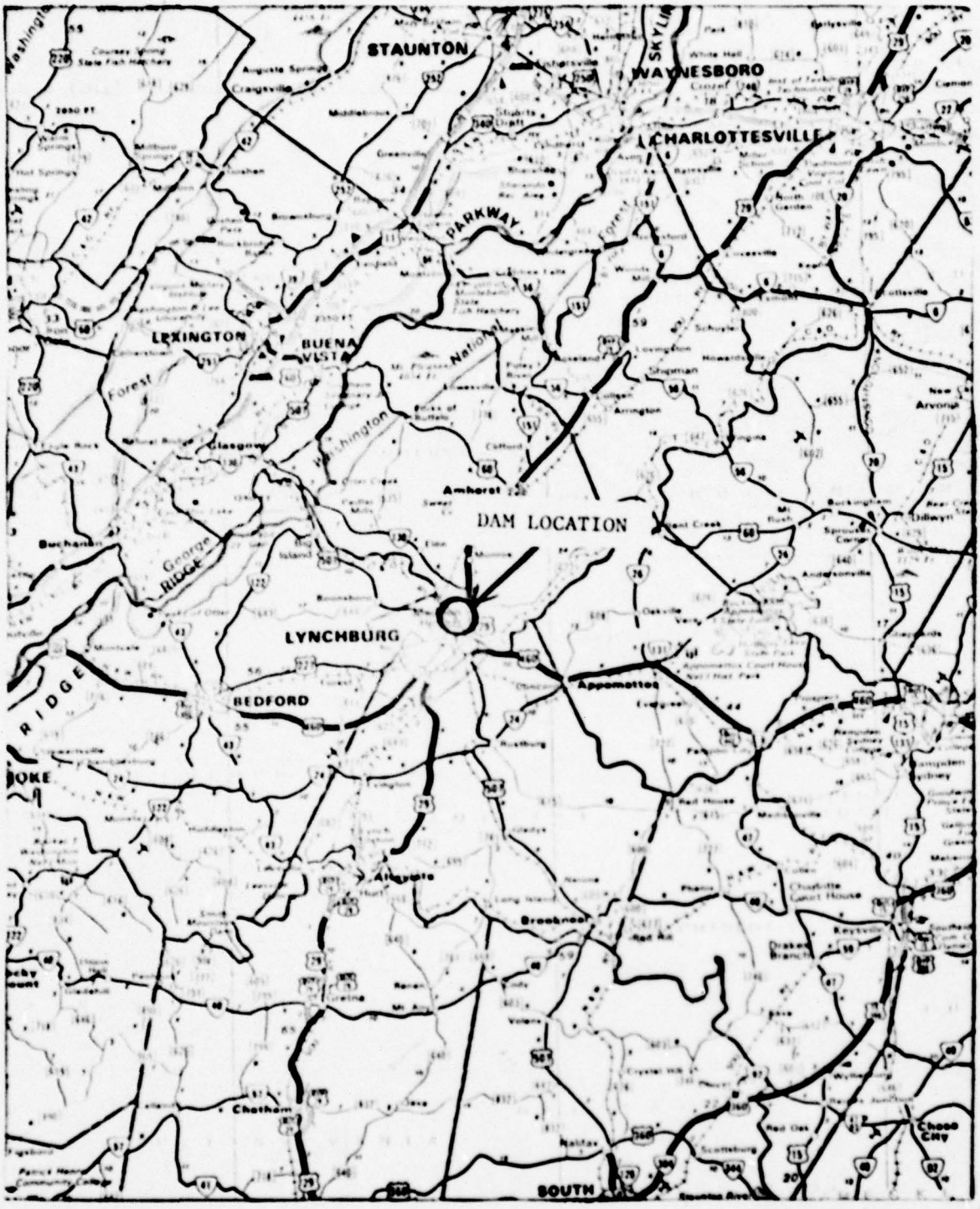
Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE) the Spillway Design Flood is 1/2 PMF. The spillway will pass 6% of the PMF without overtopping thd dam. The 1/2 PMF will overtop the dam by 25.5 feet. The spillway is therefore adjudged inadequate. The dam was designed to be overtopped.

Overall, the dam is in good condition and there is no immediate need for remedial measures because it is basically a run of the river dam with very little storage between headwater and tailwater during major flood conditions.

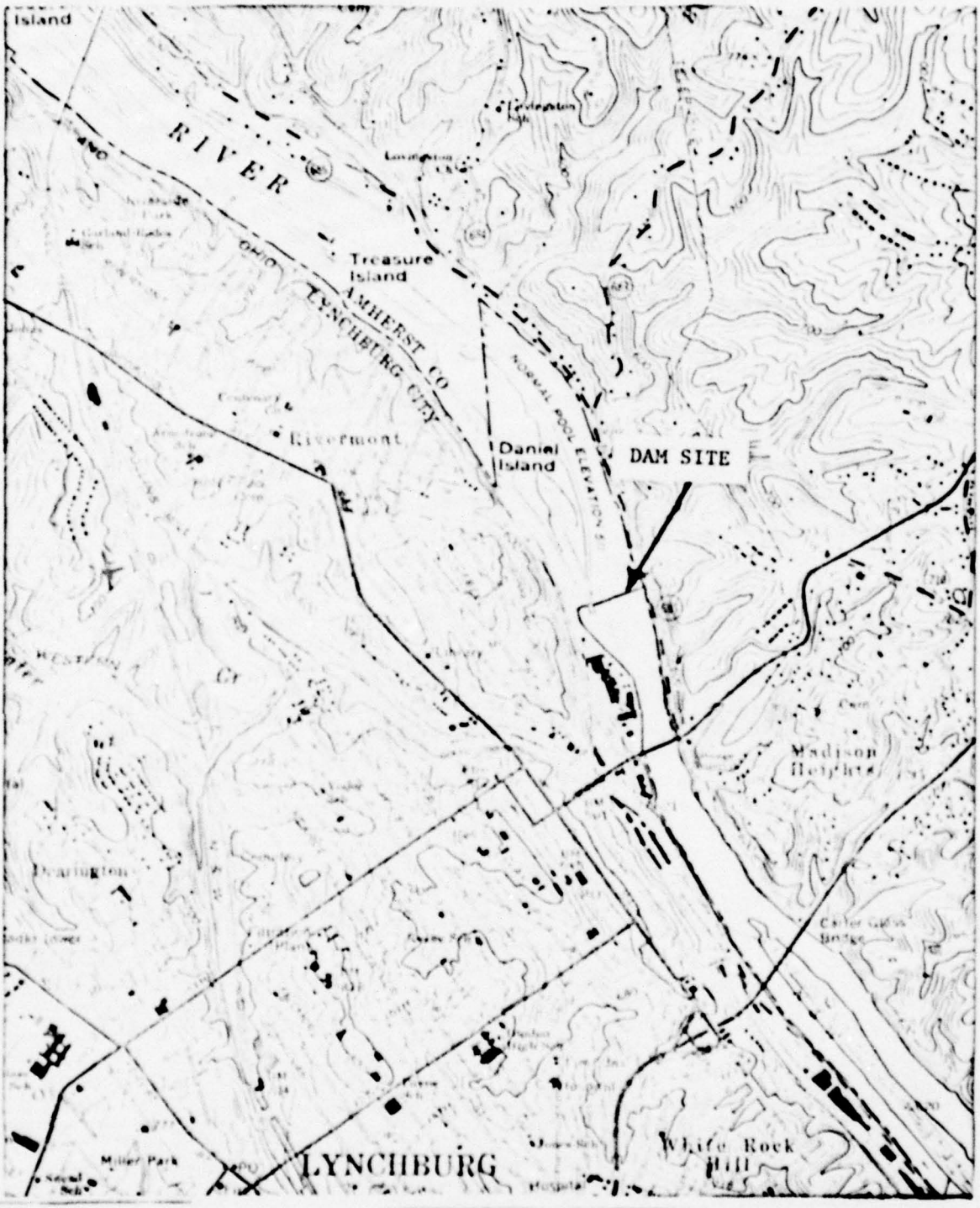
7.2 Recommended Remedial Measures: There were no critical deficiencies reported in the visual inspection which required immediate remedial action. It is recommended that the owner initiate an annual maintenance and inspection program in order to help detect and control problems which may occur.

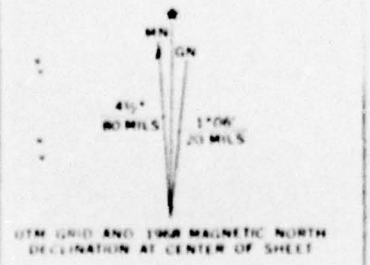
APPENDIX I

MAPS AND DRAWINGS



REGIONAL MAP
SCOTTS MILL DAM





UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LYNCHBURG, VA.
NW/4 LYNCHBURG 15' QUADRANGLE
N3722.5—W7907.5/7.5
1963

AMS 5158 I NW—SERIES V834

Scale: 1" = 2000'
10' Contours

VICINITY MAP
SCOTTS MILL DAM

APPENDIX II

PHOTOGRAPHS

SCOTTS MILL DAM

PHOTOGRAPH NO. 1
The Straight Spillway

PHOTOGRAPH NO. 2
The Arc Spillway

PHOTOGRAPH NO. 3
Canal and Gates

PHOTOGRAPH NO. 4
Griffin Pipe Company
Plant on the Downstream Shore

PHOTOGRAPH NO. 5
Left Abutment

PHOTOGRAPH NO. 6
Downstream

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Scotts Mill Dam County City of Lynchburg State Virginia Coordinates Lat. 3725.5 / Long. 7908.5

Date(s) Inspection 7/12/79 Weather Overcast Temperature 70°F

Pool Elevation at Time of Inspection 511.5 M.S.L. Tailwater at Time of Inspection 499 M.S.L.

Inspection Personnel:

M. A. White , APC
Grady Parker , APC
Bert Black , Law Engineering
Scott McDonald , APC
Tan Young , DWSA
Lyla Post , APC
Hugh Gildea , SWCB
Paul Seiler , DWSA Recorder

Appalachian Power Co. (APO)

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	Seepage through the berm separating the water supply canal to Griffin Pipe Co. from the river. Dampness observed at the left abutment. Intermittant seepage on the road side of the Abutment wall through massive stone joints.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Left abutment is a massive stone wall.	Very much rock exposed in area of dam along the roadway at the left abutment.
DRAINS	Unknown.	
WATER PASSAGES	Water appears to be 6-inches deep over crest.	
FOUNDATION	Unknown.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	No previous cracking.	
VERTICAL AND HORIZONTAL ALIGNMENT	No apparent misalignments in crest.	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Entire length of dam is ungated. Spillway is at uniform crest elevation.	
APPROACH CHANNEL	Natural river bed.	
DISCHARGE CHANNEL	Natural river bed. Island 200 feet below the dam. Left bank has State Route 685 with trees and rocky 2(H):1(V) slopes to river. Right bank has canal and pipe company. Streambed is generally rock-outcropping.	
BRIDGE AND PIERS	None.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	The city bench mark is 3 blocks from the River at a bridge 3/4 miles downstream from bridge.	
OBSERVATION WELLS	None.	
WIERS	None.	
PIEZOMETERS	None.	
OTHER	None.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Large trees on the left river bank. The Island is forrested. Banks are 2(H):1(V) on left and flat above the 10'-12' height on the right.	
SEDIMENTATION	Unknown.	

DOWNSTREAM CHANNEL

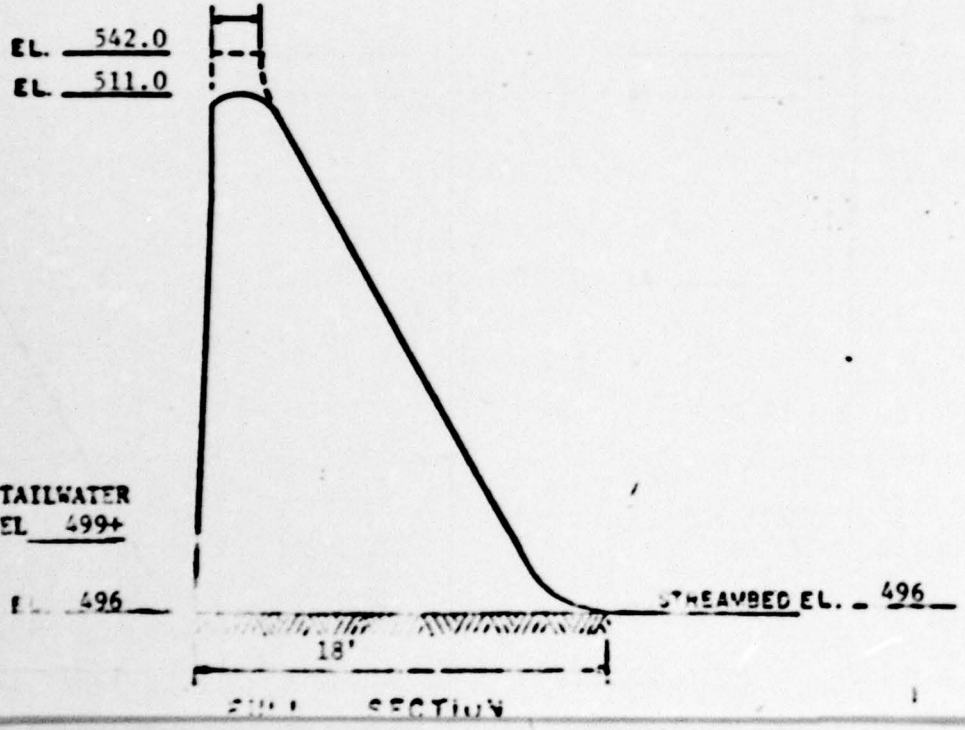
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Main channel is clear. There is an island 200 feet downstream about 150 to 200 feet wide. The channel is at bedrock.	
SLOPES	Natural River banks. Slopes are 2(H):1(V) on left and flat on right above 10'-12- height. The lower bank is about 2(H):1(V).	
APPROXIMATE NO. OF HOMES AND POPULATION	There are no homes in the nearby downstream. However, Griffin Pipe Co. plant is immediately downstream on the right shore.	

GRAVITY DAM DESIGN
STABILITY ANALYSIS

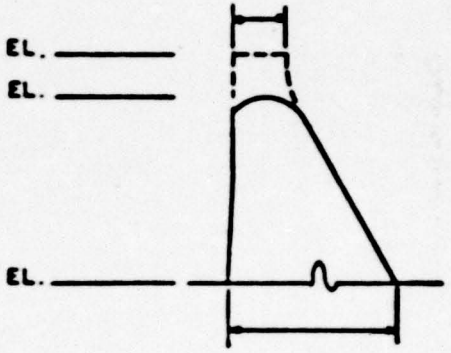
SCOTTS MILL DAM

ANALYSIS DONE ON XX FULL SECTION ___ PARTIAL SECTION
LOCATION OF SECTION CENTER OF SPILLWAY
ANALYSIS PREPARED BY

LOADING CASE	ELEV. HEAD WATER	ELEV. TAIL WATER	ΣV	ΣH	ΣH/ΣV	LOCATION RESULTANT FROM TOE	% BASE IN COMPRESSION	FACTOR SAFETY SLIDING	FOUNDATION PRESSURE	
									TOE	HEEL
NORMAL POOL	511.0	499.0	18.9^{k}	7.2^{k}	.42	6.1'			2.1^{ksf}	--
1/2 PMF	542.0	540.2	14.3^{k}	5.0^{k}	.35	6.3'			1.5^{ksf}	0.1^{ksf}



FULL SECTION



PARTIAL SECTION

THIS ANALYSIS IS BASED ON THE ASSUMED GEOMETRIC CONFIGULATION SINCE NO DRAWINGS WERE AVAILABLE TO VERIFY THE DIMENSIONS OF THE DAM.

APPENDIX IV

PARTIAL REPORT
WOODWARD-CLYDE CONSULTANTS
1978

Report On
Dam Safety Inspection
LYNCHBURG DAM
Lynchburg, Virginia

Prepared by
Woodward-Clyde Consultants
Clifton, New Jersey

For

AMERICAN ELECTRIC POWER SERVICE CORPORATION
Two Broadway
New York, New York

18 July 1978

77C110

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
2.0	PROJECT DESCRIPTION	1
3.0	SITE GEOLOGY	3
4.0	SUMMARY OF ENGINEERING DATA AVAILABLE	3
5.0	RESULTS OF VISUAL INSPECTION	4
6.0	OPERATIONAL PROCEDURES - MONITORING & WARNING SYSTEMS	5
7.0	HYDROLOGIC EVALUATION	6
8.0	OVERALL EVALUATION	7

TABLES

FIGURES

APPENDIX A - PHOTOGRAPHS

APPENDIX B - VISUAL INSPECTION CHECKLIST

LYNCHBURG DAM

1.0 INTRODUCTION

The results of a dam safety inspection of Lynchburg Dam are presented in this report. The purposes of the investigation were to gather and evaluate available data on the design and construction of Lynchburg Dam and to complete a visual inspection of the integrity of the dam so that an evaluation could be made of the need for additional investigation and/or remedial action.

The investigation was performed in accordance with our proposal dated 11 October 1977. The investigation consisted of review of data concerning Lynchburg Dam available in AEP's files, field inspection of the dam, engineering evaluation and preparation of this report. The field inspection was performed on 12 May 1978 by Messrs. John H. Frederick, Jr. and Noel Ravneberg. They were accompanied by Mr. S. McDonald of Appalachian Power Co., Hydro Division.

2.0 PROJECT DESCRIPTION

The location of Lynchburg Dam is shown in Figure 1. The dam is believed to have been constructed to provide power for a mill sometime between 1830 and 1840. Lynchburg Dam is completely formed of large stone blocks, apparently quarried from portions of the bedrock of the area. It spans the entire width of the James River at a uniform crest elevation, reported to be el 515.3 ft.* It crosses the James River at a location

*USGS sea level datum

where the hard rock of the river bottom is at or near el 500 ft. Thus, the structural height of the dam, from foundation to crest, is approximately 15 feet.

The dam was constructed in two sections; a straight-line section between Daniel Island and the eastern shore of the river, and an arc section, curved upstream, between the western shore and Daniel Island. Both sections function as gravity dams, depending largely on the weight of the blocks to resist sliding and overturning. The total crest length is approximately 925 ft.

There is a small masonry or stone structure at the tip of Daniel Island separating the curved and straight-line portions of the dam. The purpose or function of this structure is not known.

The James River currently flows over the entire crest of the dam. Originally, water was routed through sluice gates in the left abutment and through canal running along the western shore immediately downstream of the right abutment. The left abutment sluice gates have been plugged with concrete and are now buried beneath the rubble of the recently demolished mill. However, some of the right abutment canal gates are still functional. They are used to regulate the canal water supply for the Griffin Pipe Co. plant located on the western shore. (Only part of the original canal and lock system remains today the rest has been filled in.)

Because of the age of this structure, no original design or construction records could be located. Further, the mill, locks, and canal for which this facility was built, have been out of service for a number of years. Therefore, existing files contain no information concerning the operation or maintenance of the dam.

3.0 SITE GEOLOGY

Lynchburg Dam is located within the Valley and Ridge physiographic province where the bedrock is a portion of the Lynchburg formation. Although steeply folded, the phyllite bedrock (a metamorphic rock between a slate and schist), which is the primary rock material in the area, exposed near the left abutment appears very competent. The strike of the bedrock in the vicinity of the dam is approximately parallel to the axis of the dam.

The dam and the former canal system are constructed of cut blocks of gneiss. These gneissic blocks show no weathering on exposed surfaces. Solution channeling or erosion from seepage within the bedrock should not be expected.

4.0 SUMMARY OF ENGINEERING DATA AVAILABLE

As mentioned earlier, there is virtually no engineering design or construction data available for Lynchburg Dam. The only drawing made available to us was a copy of a 1941 survey of the dam. The survey is presented herein as Figure 2.

5.0 RESULTS OF VISUAL INSPECTION

Lynchburg Dam was inspected on 12 May 1978. The inspection consisted of a visual survey of both abutments, of the old sluice and canal gate structures and to the extent possible, of the dam face. Inspection of the dam crest was not possible as water was flowing over the crest at the time of the inspection.

The results of the visual inspection are described in the Visual Inspection Check List contained in Appendix B and are summarized below. Photos of the dam are presented in Appendix A.

1. There was no evidence of seepage flow in the right abutment.

2. A sketch showing schematically the layout of the sluice gate structure at the left abutment is presented in Fig. 5. The stone blocks in the left abutment, appeared wet, although no flowing water was noted. We understand that the mill located at the left abutment was demolished within the last few years. The debris from demolition of the mill has partly filled the sluice gate structure and the sluice gates are no longer visible. Photographs of the sluice gate structure taken prior to demolition of the mill show water leaking thrcugh the plugged sluice gates. Although the sluice gates are no longer visible, we presume the leakage is continuing.

3. The flow over the dam appeared smooth suggesting that there is very little deterioration or erosion of the stone blocks which make up the dam.

At the time of the inspection water approximately two feet deep was passing over the dam crest.

4. There was no visual evidence of instability at either of the abutments.

5. There was no visual evidence of distortions in alignment or grade which would be indicative of movement of the dam.

6. The downstream area adjacent to the James River is sparsely populated. (The populated areas are located on high ground, 100 to 200 ft above normal river level.)

6.0 OPERATIONAL PROCEDURES - MONITORING & WARNING SYSTEMS

Lynchburg Dam is no longer in service. Thus, formal procedures for operation of the dam do not exist (nor are they needed). We understand that the Griffin Pipe Company has no formalized operating procedures in effect for its operation of the canal gates.

To our knowledge, there is no program of regular inspections of the dam or abutments in effect. Similarly there is no planned warning system in effect to alert residents or persons responsible for structures located downstream that could be affected by failure of the dam.

The dam has stood and performed satisfactorily for over 100 years. Although there is little likelihood, in our opinion, of failure of the dam (see sections 7.0 and 8.0 of this report), the application for an operating permit for this dam is likely to have to be accompanied by documentation of an emergency warning system.

7.0 HYDROLOGIC EVALUATION

There are no river flow data available for the Lynchburg Dam site. However, flow data shown in Fig. 4 from stations along the James River, indicate that there is little variation in flow characteristics between the station located immediately upstream of Lynchburg (Holcombs Rock) and that located downstream (Bent Creek). We therefore have assumed that the flow data for the Holcombs Rock gaging station are representative of the flows likely to be experienced at the Lynchburg Dam site.

The estimated river flow at Holcombs Rock for various recurrence floods is shown in Table 1 below. The flow data were obtained from USGS publications* and by personal communication with USGS personnel.

TABLE 1

Recurrence Interval, years	Peak River Flow, cfs
2	49,300
5	70,600
10	84,600
25	102,000
50	115,000
100	127,000

On a number of occasions in the past, peak flows exceeding 100,000 cfs have been recorded:

---

*Miller (1978) "Technique for Estimating Magnitude and Frequency of Floods in Virginia", USGS Water Resources Investigation 78-5

Date of Occurrence	Peak Flow, cfs
March 28, 1913	118,000
March 18, 1936	115,000
August 20, 1969	150,000
June 21, 1972	126,000

On the day of our inspection, May 12, 1978, the daily mean flow at Holcombs Rock was 6,880 cfs.

From these data, it is evident that Lynchburg dam has experienced flows far in excess of the flow occurring at the time of our inspection. The largest flows, (close to or in excess of the 100 yr flood) were experienced and survived, within the last 10 years.

8.0 OVERALL EVALUATION

Since there are no design data or construction records available, our evaluation is based solely on the visual inspection and on the performance of the dam to date.

Lynchburg Dam has performed satisfactorily for over 100 years and exhibits no current signs of distress or significant deterioration. Flood flows in excess of the 100 yr flood have passed safely over the dam. We therefore assess the probability of failure as small.

The most credible method of failure that we could postulate would be an overturning failure in the event of an unprecedented flood. In the event, the contribution from the loss of water in storage would be inconsequential with respect to the total flow in the river at the time of failure. Therefore, the resulting loss and damage downstream from the dam would not be materially greater than that which would occur as a result of the flood itself.

5.8.1 Hazard Classification

The Corps of Engineers' Inventory indicates a classification of "High" hazard potential for Lynchburg Dam. Because flooding, resulting from a postulated failure of the dam, would be mostly confined to the existing river bed, it is likely that few lives would be lost in the event of failure. Therefore, it is not clear to us that the hazard potential should be indicated as "High". Rather a classification of "Significant", according to the Corps' definition, may be more appropriate.

5.8.2 Remedial Work

In our opinion, Lynchburg Dam does not create a risk to the safety and property of people in the downstream area. We find no reasonable cause for remedial action to improve the safety of this dam.

APPENDIX V

REFERENCES

LIST OF REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.